

19th ICCRTS
Operationalizing C2 Agility

“DoD Application Store: Enabling C2 Agility?”

Topic:
Topic 3: Data, Information, and Knowledge

Ms. Amanda George (Point of Contact)
Captain George Galdorisi (U.S. Navy – Retired)
Mr. Michael Morris
Mr. Matthew O’Neil

Space and Naval Warfare Systems Center Pacific
53560 Hull Street
San Diego, California 92152-5001
(619) 553-2066
amanda.george@navy.mil

Report Documentation Page		Form Approved OMB No. 0704-0188
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.		
1. REPORT DATE JUN 2014	2. REPORT TYPE	3. DATES COVERED 00-00-2014 to 00-00-2014
4. TITLE AND SUBTITLE DoD Application Store: Enabling C2 Agility?		5a. CONTRACT NUMBER
		5b. GRANT NUMBER
		5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER	
	5e. TASK NUMBER	
	5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Space and Naval Warfare Systems Center Pacific, 53560 Hull Street, San Diego, CA, 92152-5001		8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited		
13. SUPPLEMENTARY NOTES Presented at the 18th International Command & Control Research & Technology Symposium (ICCRTS) held 16-19 June, 2014 in Alexandria, VA.		
14. ABSTRACT The Department of Defense and the military Services are currently working to provide widget and app storefronts to disseminate applications that enable agile, composable, C2 capabilities. This paper will examine the technical and non-technical lessons learned through the effort to implement the DoD Application Store on an Ozone Widget Framework. The government-developed open source Ozone Widget Framework will allow developers of web applications to register their app in a single repository where it can be discovered, used, and composed by the warfighter. The DoD Application Store, as an Ozone Marketplace within the Ozone Widget Framework, will include automated delivery of software patches, web applications, widgets and mobile application packages. The envisioned DoD Application Store will deliver software from a central repository, over the land or air, to the warfighter at the tactical edge thereby increasing C2 agility. Over the last several years DISA, PEO C4I, and SSC Pacific have moved to implement this framework, and have discovered a number of additional benefits and encountered previously unknown obstacles. As the DoD has moved to emphasize the importance of efficiency and cost savings, the savings offered by this agile C2 solution have grown even more important as the current methods of distributing software components to the tactical edge are time consuming and costly. While the ability to distribute application packages to the tactical edge is technically feasible, the process of shaping the DoD acquisition system to match the agility of the C2 tools has been challenging.		
15. SUBJECT TERMS		

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 48	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Abstract

DoD Application Store: Enabling C2 Agility?

The Department of Defense and the military Services are currently working to provide widget and app storefronts to disseminate applications that enable agile, composable, C2 capabilities. This paper will examine the technical and non-technical lessons learned through the effort to implement the DoD Application Store on an Ozone Widget Framework. The government-developed open source Ozone Widget Framework will allow developers of web applications to register their app in a single repository where it can be discovered, used, and composed by the warfighter. The DoD Application Store, as an Ozone Marketplace within the Ozone Widget Framework, will include automated delivery of software patches, web applications, widgets and mobile application packages. The envisioned DoD Application Store will deliver software from a central repository, over the land or air, to the warfighter at the tactical edge thereby increasing C2 agility.

Over the last several years DISA, PEO C4I, and SSC Pacific have moved to implement this framework, and have discovered a number of additional benefits and encountered previously unknown obstacles. As the DoD has moved to emphasize the importance of efficiency and cost savings, the savings offered by this agile C2 solution have grown even more important as the current methods of distributing software components to the tactical edge are time consuming and costly. While the ability to distribute application packages to the tactical edge is technically feasible, the process of shaping the DoD acquisition system to match the agility of the C2 tools has been challenging.

Paper

DoD Application Store: Enabling C2 Agility?

Background

As the Department of Defense (DoD) and the United States military services move to encourage and enable agile C2, a major hurdle still stands in the way: an acquisition system geared towards procuring large items, like air craft carriers, rather than continuously evolving software applications. As many defense experts have observed over the last decade, the DoD acquisition system has been plagued with ongoing challenges in weapons acquisition programs including cost growth and schedule delay. These difficulties have been particularly apparent in the realm of hardware and software needed to create the command and control (C2) tools to enable agile C2 and lead to decision superiority.

The challenges in acquiring the tools necessary to enable agile C2 are particularly important given the premium the U.S. Services, and the U.S. Navy in particular, have placed on the need for decision superiority. To enable effective maritime superiority and maintain global maritime awareness, the U.S. Navy has made information a “main battery” of its arsenal. Information, when networked across joint, allied, and coalition forces provides commanders with the ability to cooperatively create a common operating picture—to better able to see what is over the horizon faster than the adversary. As noted in the U.S. Navy’s *Vision for Information Dominance*:

[T]he Navy will create a fully integrated C2, information, intelligence, cyberspace, environmental awareness, and networks operations capability and wield it as a weapon and instrument of influence.¹

Enhancing its proficiency in operating within the information domain will also allow the Navy to: better respond to a rapidly changing battlespace as it takes advantage of advanced IT and networks; develop a global enterprise through network centric operations and command and control (C2); and elevate the use of information as a main weapon alongside traditional weapons.

As *Global Trends 2030* notes, “the world of 2030 will be radically transformed from our world today.”² The United States, and indeed no other country, will be a hegemonic power. In a

¹ Department of the Navy (DoN), *Vision for Information Dominance* (Washington, D.C.: Department of the Navy, 2010).

² Office of the Director of National Intelligence, *Global Trends 2030*, (Washington, D.C.: National Intelligence Council, December 2012) iii.

multipolar world, the United States will face a security environment that uncertain. At the same time, the United States is facing increasing economic pressures at home. The recent cuts in the U.S. defense budget, and the strong possibility that more are forthcoming, have precipitated a vigorous strategic analysis within the defense community. The recently released documents *Quadrennial Defense Review 2014*³, *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense*⁴ and *Defense Budget Priorities and Choices*⁵ lay out the United States' military response to fiscal pressures at home and uncertainty abroad. *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense*—otherwise known as the Defense Strategic Guidance (DSG)—notes: “the global security environment presents an increasingly complex set of challenges and opportunities to which all elements of U.S. national power must be applied.”⁶ As such, despite budget pressures:

For the foreseeable future the United States will continue to take an active approach to countering these threats by monitoring the activities of non-state threats worldwide, working with allies and partners to establish control over ungoverned territories and directly striking the most dangerous groups and individuals when necessary.⁷

The recently released *Quadrennial Defense Review 2014*, “embodies the 21st century defense priorities outlined in the 2012 Defense Strategic Guidance.”⁸ The *Quadrennial Defense Review 2014* goes on to emphasize the importance of innovation in order to enable:

New presence paradigms, including potentially positioning additional forward deployed naval forces in critical areas, and deploying new combinations of ships, aviation assets, regionally aligned or rotational ground forces, and crisis response forces, all with the intention of maximizing effects while minimizing costs.⁹

As emphasized in previous documents, the United States will perform this task in part by being selective about committing its forces. The DSG states “our forces must be capable of deterring and defeating aggression by an opportunistic adversary in one region even when our forces are committed to a large--- scale operation elsewhere.”¹⁰ This is a profound change from the

³ Department of Defense (DoD), *Quadrennial Defense Review* (Washington, D.C.: Department of Defense, 2014).

⁴ Department of Defense (DoD), *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* (Washington, D.C.: Department of Defense, 2012).

⁵ Department of Defense (DoD), *Defense Budget Priorities and Choices* (Washington D.C.: Department of Defense, 2012).

⁶ Department of Defense (DoD), *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* (Washington D.C.: Department of Defense, 2012), 1.

⁷ Department of Defense (DoD), *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* (Washington D.C.: Department of Defense, 2012), 1.

⁸ Department of Defense (DoD), *Quadrennial Defense Review* (Washington, D.C.: Department of Defense, 2014).

⁹ Department of Defense (DoD), *Quadrennial Defense Review* (Washington, D.C.: Department of Defense, 2014).

¹⁰ DoD, *Sustaining U.S. Global Leadership*, 1.

previous “two-war doctrine” in which the United States maintained the capability to fight two full-scale wars simultaneously. The *Defense Budget Priorities and Choices* states, “this strategic precept puts a premium on self- and rapidly- deployable forces that can project power and perform multiple mission types.”¹¹

As the U.S. faces the uncertain, rapidly changing security environment described in its strategic documents, “[a]gility is increasingly becoming recognized as the most critical characteristic of a transformed force, with network-centricity being understood as the key to achieving agility.”¹² Today, agility is no longer “merely an *attribute* of the C2 system,”¹³ instead “military establishments have recognized that ability considerations must *permeate* the mission capability package, operational concept, or force.”¹⁴ (emphasis in original)

This paper will focus on the possibility that the use of widgets and applications, hosted on a DoD-wide applications store, using the Ozone Widget Framework, can enable agile C2 by utilizing an agile acquisition and governance process to quickly deploy composable C2 capabilities to the U.S. military. The work at the U.S. Navy’s Space and Naval Warfare Systems Center Pacific has shown this approach to be technically feasible, but there have been significant challenges in adjusting the acquisition process to facilitate the quick deployment updated widget and application packages.

Widget & App Stores

One recent innovation, both in the technology and its operational use, is the growing importance of widgets and applications offered to the warfighter through an application storefront. The use of widgets and apps increases the agility of a military unit, be it a commander in a command center or a sailor deployed on a cruiser. Through widgets and specialized apps the warfighter can easily access data to increase situational awareness as well as connect rapidly with a command center. Widgets and application packages provide the command center and the warfighter the ability to rapidly adapt their information sources to their information needs. The widgets, each providing tailored information and services, can be composed in a variety of ways for the warfighter to tailor the specific information that is needed, while culling out the information that is unnecessary for the task at hand.

¹¹ Department of Defense (DoD), *Defense Budget Priorities and Choices* (Washington D.C.: Department of Defense, 2012), 7.

¹² David S. Alberts and Richard E. Hayes, *Power to the Edge* (Washington, D.C.: DoD Command and Control Research Program, 2005), 126.

¹³ David S. Alberts and Richard E. Hayes, *Power to the Edge* (Washington, D.C.: DoD Command and Control Research Program, 2005), 126.

¹⁴ David S. Alberts and Richard E. Hayes, *Power to the Edge* (Washington, D.C.: DoD Command and Control Research Program, 2005), 127.

Currently, the C2 systems for warfighters are hard-coded to perform a single mission. Each ship or unit is outfitted with the C2 information and tools that are applicable to the mission it is deployed to do. If there is enough room, then alternate tools may be loaded, but given the information storage constraints in any deployment, be it naval or expeditionary, there is finite space for additional C2 tools not tailored to the current mission. Basically, the current process puts as many capabilities in one bag as can fit and sends the units out to perform within that bag of capabilities requiring different units to have different fixed sets of capabilities and to be constrained to those actions only. Thus warfighters face the challenge that their C2 abilities are limited by the tools that they deploy with. This limitation constrains the warfighters' ability to quickly change missions without returning to base. Widgets and application packages offered in a storefront, combined with an afloat or expeditionary cloud environment, will enable a warfighting unit to tailor its C2 capabilities to respond to changing mission requirements, without necessitating a return to its base.

The wave of the future is to provide composeable capabilities for all units. Emerging needs, codified in the DoD's strategic documents require the United States to continue to provide for a shrinking military and expanding global responsibilities. As the DSG states, "[w]henever possible, we will develop innovative, low-cost, and small-footprint approaches to achieve our security objectives, relying on exercises, rotational presence, and advisory capabilities."¹⁵ (emphasis in original) The idea of a composeable package of capabilities to assist the warfighter is not new, however, it *is* possible today. The ability to provide widgets, applications, application bundles, and services on demand to the warfighter to reconfigure mission capabilities, will enable commanders to change the mission parameters of any unit, while deployed. The unit in turn would be able to turn off and turn on capability packages as necessary to meet mission requirements.

The major enabler of this is the ability to expose and discover C2 capabilities by the warfighter. Storefronts on enterprise and deployed networks provide the ability to instantiate software and platforms as a service is a key element to providing the composeable mission capability. These devices are innovative in that they also enable the warfighter to provide pertinent data to the central command center thereby increasing total situational awareness. The DoD and the military Services are currently working to provide widget and app storefronts to disseminate applications. The storefronts will enable the developers of the widgets and apps to be more responsive to user needs by allowing them to field innovative products tailored to current needs. DoD has started to make inroads within this environment with several Programs of Record (PoR) embracing widgets and other mobile technologies, hoping to enhance warfighter situational awareness and access to information. Unfortunately, the Defense Acquisition System has not

¹⁵ Department of Defense (DoD), *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* (Washington D.C.: Department of Defense, 2012), 3.

fully adapted to this new environment, making it difficult to field these technologies rapidly to meet emergent requirements.

Ozone Widget Framework (OWF)

What is a widget?

Widgets are lightweight, single-purpose, web-enabled applications users can configure to their specific needs. Widgets can provide summary information or a limited view into a larger application and can be used alongside related widgets to provide an integrated view as required by the user.

OWF

The Ozone Widget Framework (OWF) is a platform that offers infrastructure services to simplify the development of workflows and presentation-tier application integration. It is also a layout manager for the operation of widgets on a single web page. Widgets, which are web applications that can be installed and executed in a web browser, display information or provide dynamic content from a backend or local service. Just like any other widget framework, OWF supplies the structure and templates for creating widgets providing users with the capability to develop, share, and operate widgets. Unlike a standard browser window, OWF allows users to load and operate multiple widgets within a single webpage rather than requiring multiple browser windows or tabs to display more than one widget. This allows users to view a great amount of information on a single browser interface. From an intelligence analyst's standpoint, the OWF provides a means to conveniently search, access, and display intelligence data on a single display. Furthermore, the OWF allows the user to adapt their information flows by adding, deleting or modifying the loaded widgets, in the shortest amount of time. In under a minute, an OWF operator can change the information they have access to, allowing the user to agilely adjust to changing circumstances.

OWF allows users to load widgets, select a layout type called a dashboard layout, and customize the arrangement of the widgets within the dashboard. OWF supports multiple dashboard layouts including desktop, tabbed, portal, and accordion. The desktop layout allows users to arrange and drag widgets anywhere within the browser window much like a desktop application on a standard operating system desktop. The tabbed, portal, and accordion layouts fix the widget positions in the browser, but users are able to select which widgets are assigned to the fixed locations creating a customized display. The dashboard layout and arrangement of widgets is saved when a user logs out of the OWF, so the next time the account is accessed the entire layout

is maintained. Thus, a user could have a dashboard specifically targeted to address multiple scenarios; this moves the operator away from the stove piped information system.

The OWF, originally developed and sponsored by the National Security Agency (NSA) as a Government Off-The-Shelf (GOTS) solution, is now Government Open-Source Software (GOSS) with a collaborative software development model. The OWF GOSS Program is responsible for the maintenance of OWF and Ozone Marketplace (OMP) software releases. The OWF GOSS board, comprised of members from NSA, ODNI, DoD, CIA, DISA, SPAWAR, NRO, and INSCOM,¹⁶ can distribute development priorities to any government agency or program requesting the source code for either its own use or for updating. These agencies are encouraged to submit software patches and feature enhancements to improve the baseline code and benefit the community of projects utilizing the OWF and OMP. The OWF also provides a suite of application programming interfaces (APIs) that give widget developers the ability to further their web applications using inter-widget communication, user preferences, and internationalization. Each API is written in JavaScript so that widgets can be built in a large variety of web technologies. Therefore, widgets can be written in the JavaScript capable technology of the developer's choice. The ability of each agency to customize their APIs further allows for quick responsiveness.

Widgets in Action

The power of widgets and apps to provide agile C2 is being recognized across the DoD. The recognition of the power of these apps is driving a push to change the acquisition structure of these products to allow them to be fielded in a responsive manner. The Navy's Program Executive Office for Command, Control, Computers, Communications and Intelligence (PEO C4I) is actively working to implement a storefront and a widget acceptance process through which widgets can be fielded through an already existing program of record and thereby reach the user in a timely fashion. Command and Control and Intelligence widgets as well as the Ozone Market Place (OMP) provide examples of this adoption of widgets. These C2 widgets, when fielded, provide agile C2 capabilities in response to emergent warfighter requirements.

PEO C4I Storefront Overview

Before new capabilities are made available to the warfighter, they must undergo developmental tests, operational tests, and a strict certification and accreditation (C&A) process. This process

¹⁶ The OWF GOSS board includes members from: the Office of the Director of National Intelligence (ODNI), the Central Intelligence Agency (CIA), the Defense Information Systems Agency (DISA), Space and Naval Warfare Systems Center (SPAWAR), the National Reconnaissance Office (NRO), and United States Army Intelligence and Security Command (INSCOM).

can take as long as nine months, enough time for the “new” technology to become out of date and unresponsive to immediate user needs. Widgets provide a technological capability now to foster this rapid fielding ability and provide the potential to rapidly implement C4ISR and operational capabilities for the war fighter. Widgets are being deployed in the Navy operational environment as part of formal software builds and releases for Programs of Record (PoRs). The PEO C4I Storefront and a governance process specific to widgets submitted by an accredited PoR will reduce lead times and ensure that widgets are efficiently and securely introduced for the warfighter in a production environment.

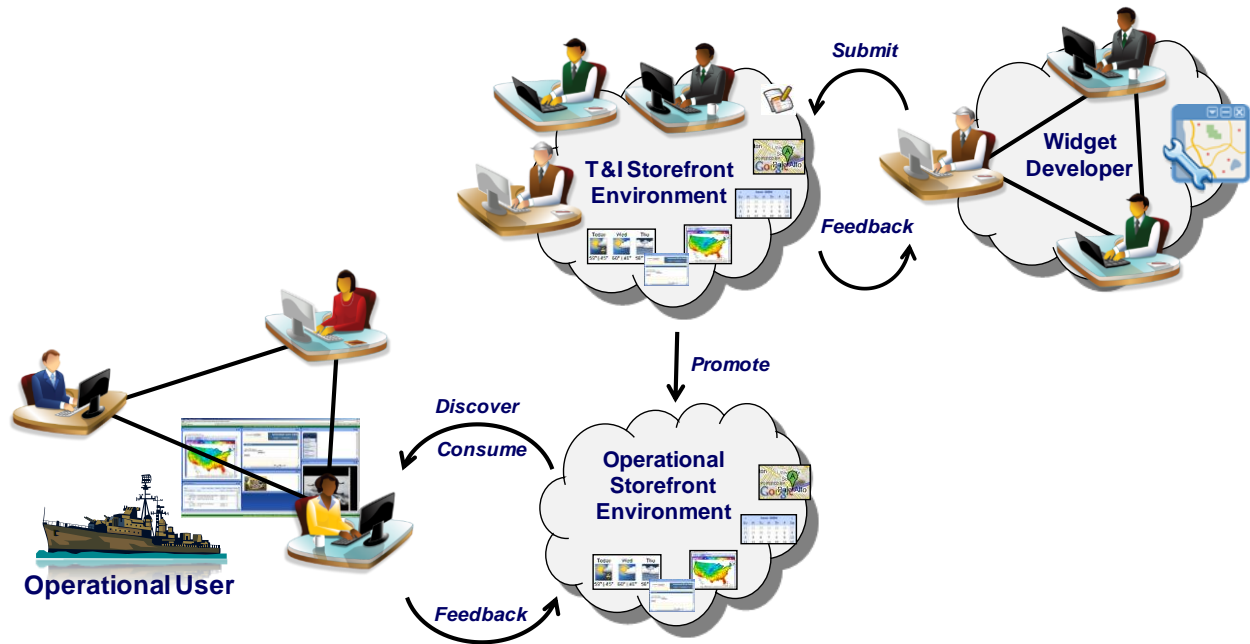
Using the widget framework, the operator is not only able to be successful but is able to maintain “success in light of changed or changing circumstances”¹⁷ a key component of agile C2. The PEO C4I Storefront provides an example of how quickly widgets can be created and fielded when they are associated with an already accredited PoR. The DoD would be well-served to examine its acquisition paths and to adopt widgets and associated storefronts at an accelerated pace in order to enable agile C2. As *Global Trends 2030* notes “the future world order will be shaped by human agency as much as unfolding trends and unanticipated events.”¹⁸ The DoD should enable its commands to be able to respond to these events with innovative approaches as exemplified by the use of widget and application storefronts described in this paper.

The PEO C4I Storefront seeks to increase the speed at which new capabilities are provided to the warfighter by creating an efficient test, verification and validation process to govern widgets. Figure 1 depicts the operational concept of the PEO C4I Storefront. A widget developer produces a widget which he or she submits to the Test and Integration (T&I) Storefront Environment for testing. The Widget Test and Integration Team provides feedback to the widget developer on improvements needed to make the widget compliant with the Operational Storefront standards. Upon completion of all testing, the widget is promoted to the Operational Storefront Environment. From there, the Operational User can discover the widget from a Marketplace (applications store) and consume the capability in an operational environment. Ultimately, the operational user can provide feedback about the widget to build on the existing capability or to evolve new capabilities.

¹⁷Alberts, *The Agility Advantage*, 66.

¹⁸ National Intelligence Council (NIC), *Global Trends 2030: Alternative Worlds* (Washington D.C.: Department of Defense, 2012), 3.

Figure 1: PEO C4I Storefront Operational Concept

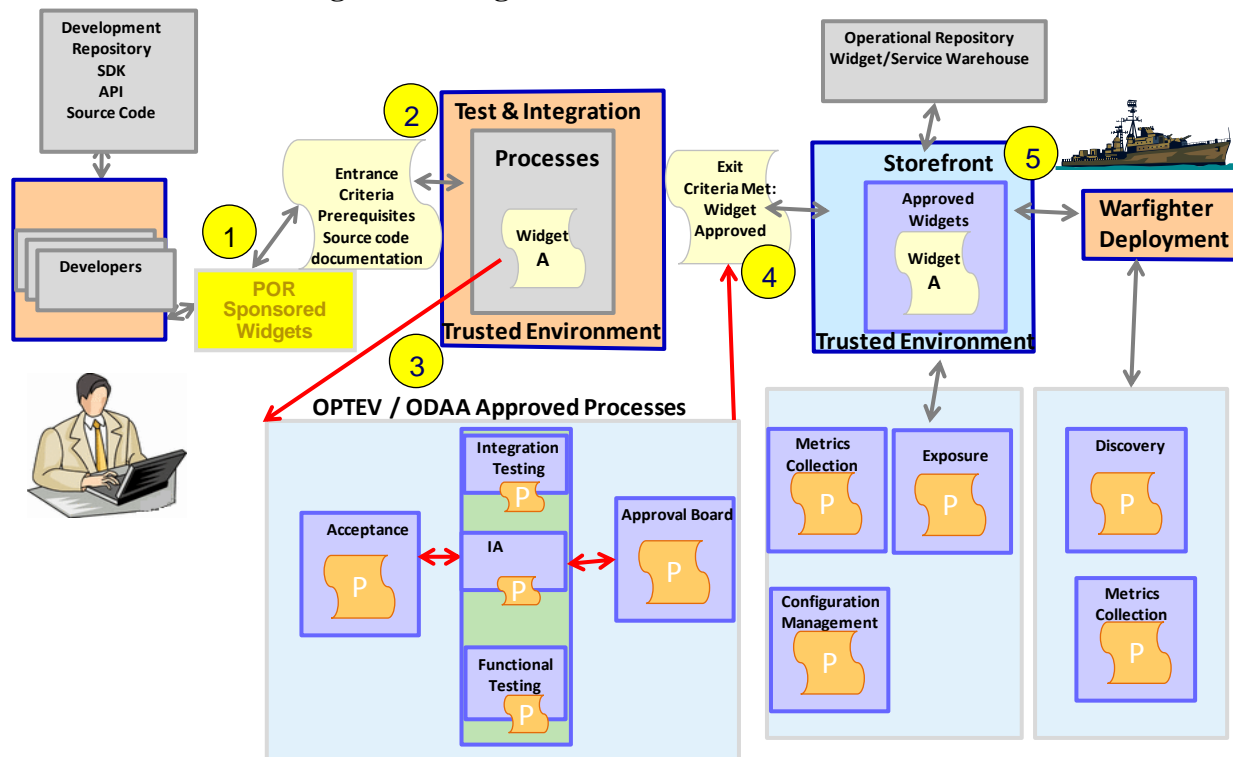


Widget Governance Tool

Widget governance describes how an organization establishes and controls its processes and policies regarding widgets. It includes a system to track and record where a widget is within a widget process and checks for its compliance with existing policies. By establishing an efficient test and evaluation process to govern widgets and approve their acceptance into a marketplace, the lead time for a developmental concept to reach the warfighter can be greatly reduced.

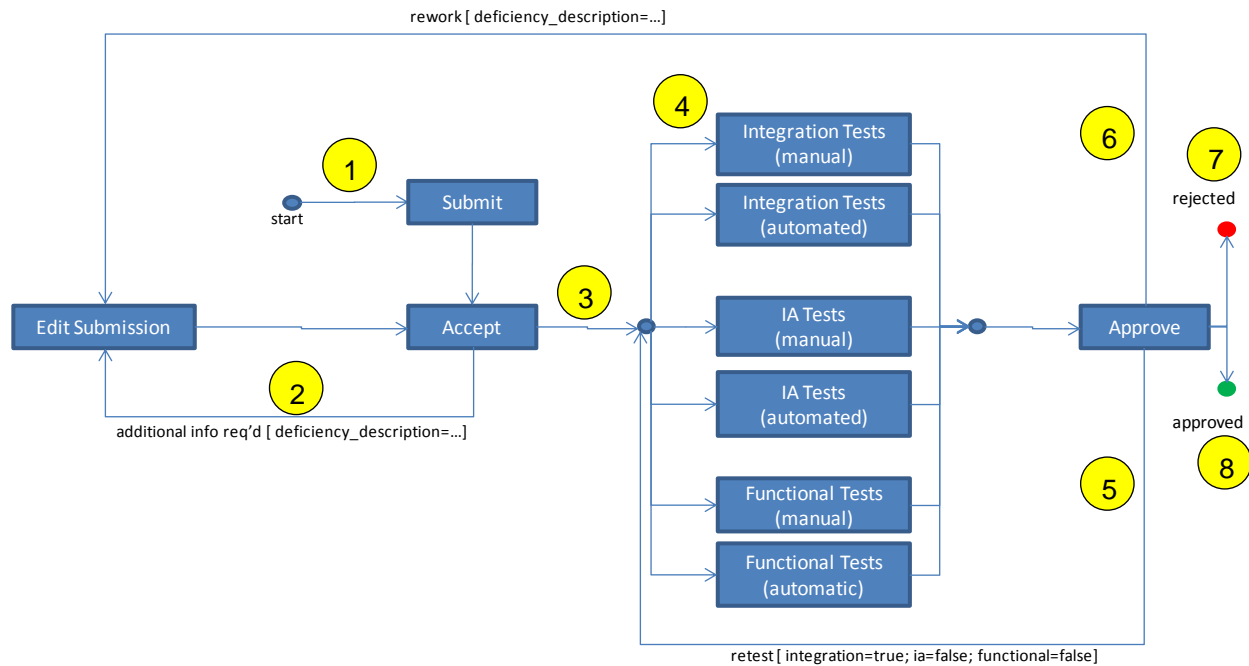
The following, described in Figure 2, is an overview of the widget governance tool that governs widgets beginning with its initial submission to the widget governance process to its acceptance into the operational environment where it becomes available for use by the warfighter.

Figure 2: Widget Governance Process Overview



Developers provide widgets to Programs of Record (PoR) which expose capabilities in a widget framework (1). The widgets must meet Entrance Criteria for introduction to the Test and Integration (T&I) environment (2), which includes the source code, descriptive metadata, configuration documentation, and developer testing results for the target production environment. Applying Navy approved processes, the widget passes through a number of manual and automated tests to ensure suitability for the production Storefront environment (3). Upon review of the test results which verify that the widget meets the exit criteria (4), the widget is approved to be introduced into the Storefront operational environment (5) and is made readily available to the warfighter. The following, detailed in Figure 3, is a process flow for the widget governance tool.

Figure 3: Detailed Widget Governance Process Flow



A Widget Submission Package (WSP) is submitted (1) which contains source code and documentation of the widget and application programming interface (API), as well as metadata describing the function, user guidance, characteristics, boundaries and deployment locations, preferred browser and system configuration, installation instructions and dependencies. Developer, Functional, Information Assurance and Integration Test Reports are also included, as well as a Mobile Code Risk Mitigation Strategy and a statement that the widget has been developed in accordance with mobile code developer's guidance and a Security Technical Implementation Guide (STIG) report. All required components of the WSP are indexed for ready reference. If the package does not pass the Acceptance test (1), a report of deficiencies is provided and the submitter is provided the opportunity to edit and correct the submission (2). If the WSP passes the Acceptance sub process, the package is provided for Functional, IA, and Integration Testing sub processes in the T&I environment (3).

The Functional, IA, and Integration testing is conducted in parallel to the greatest extent possible in order to optimize testing resources and make the procession of the WSP through the process efficient (4). Functional testing will focus on the proper operation of the widget in generating the desired output in a widget as described by the PoR. Integration testing will concentrate on how well the widget performs in the Storefront environment (e.g. with the widget framework, identity management solution, etc.) and also amidst other widgets. IA testing will ensure that the widget meets OWF standards, that backend services and data inherit configuration attributes from their accredited parent environments, that information is exchanged over a secure channel, and that the widget operates in a manner which ensures an acceptable level of security. Some

tests will be conducted manually by the T&I Testing Team, but automation is desired to the greatest extent possible to decrease the amount of time and manual effort required to designate a widget suitable for the operational Storefront environment.

Upon completion of the preceding tests, the results will be aggregated and compiled for the Approval Board sub-process. The Board may determine that a WSP needs to be returned to the T&I Test Team if the results did not demonstrate acceptable functional, information assurance or integration testing results (5). A widget may also be ordered to be reworked by the developers if major deficiencies exist which must be corrected prior to deployment to the operational Storefront environment (6). Additionally, a WSP may be rejected if the content rendered or output of the widget is deemed to be inappropriate or of no added value in the Storefront environment (7). The end goal, however, is to have the widget approved, making it available to the warfighter in from the production Storefront environment (8).

Rapid IT Process and Agile Widget Process

The current process for developing software capabilities and testing and fielding them can take up to 44 months. This process, originally designed for hardware insertions, is not only lengthy but seeks to deliver the exquisite solution to the warfighter, without warfighter input along the way. In the current process, capability development takes on average twelve to eighteen months per release; in this manner all the capabilities for a new or updated software artifact are created at once. The new capability must pass operational testing and evaluation (OT&E) testing as well as information assurance (IA) testing that take, on average, an additional six to eight months. Once the new capability is approved, it must be installed manually onboard ships. A manual install takes on average two weeks and it must align with ship schedules; therefore, due to difficulties in getting aligned with the ship schedules, the approved capability could take up to 18 months just to field. Agile widget development, working smoothly with the rapid IT release process, can increase the speed at which capabilities are released to the Fleet by providing multiple updates in six month fleet releases, getting incremental solutions to the warfighter, through the OMP, in a matter of days.

The proposed rapid IT process and agile widget process described below in Figure 4 has the ability to provide incremental capability releases to the software user. Instead of getting a complete package in 44 months, the user can get parts of the package over time, and provide input during the development, which will lead to a more agile and useful capability in a much shorter time period. During this six month time period, OT&E and IA testing will be done within the process in the space of a few weeks. Once tested and approved the new capability will be ready to be disseminated to the Fleet via the OMP, thereby making a manual install unnecessary. The end user will simply download the new capability from the Application Store.

Bypassing the need for a manual install significantly cuts the time and cost incurred in fielding new software capabilities to the Fleet because there would no longer be a need to coordinate with the ships' availabilities and there would no longer be a need to send installers to the ships.

Figure 4: Rapid IT Process and Agile Widget Process

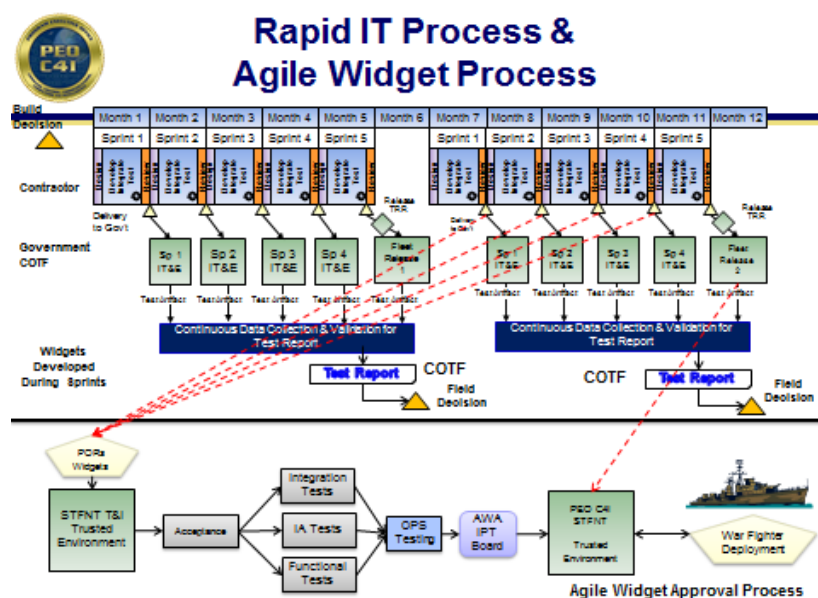


Figure 4 provides a detailed view of the rapid IT process and agile widget process working together. As top of the chart shows, the contractor for the program of record (PoR) develops capabilities – applications and widgets – using the rapid IT process. For a specific release, the POR has five monthly sprints where the results of each sprint are delivered to the government tester (the green boxes). The government, potentially including the Commander Operational Test and Evaluation Force (COTF) performs the OT&E and IA testing on the results of each sprint. In this manner, the results of the testing, including bug fixes, are included in the next spiral. After the five sprints, the COTF would have a collection of testing artifacts that can be combined over the course of the release to support a formal test report. Essentially, at the end of the five 1-month sprints, there would be the capability that has been incrementally tested (from an IA and OT perspective) and only minor regression testing would be required to generate a formal test report and make a fielding decision for the release. At this point, the release would include both widgets and their backend applications. Thus, the incremental capability would be fielded within six months.

Even though the Fleet releases would be scheduled every six months, there are some widgets that will need to be fielded faster. The red dotted lines show that at the end of a sprint, the widget could enter the AWA governance process with the letter from the PoR's Project Manager stating this widget needs to be fielded before the Fleet Release and that it doesn't change the IA

baseline. Depending on the complexity of the widget, it may require some level of IA or OT testing as shown in the testing process outlined at the bottom of the diagram. Following a similar process for the six month releases, the T&I Team will continue to provide the test artifacts back to the collection of DT/OT/OA. The Agile Widget Approval Integrated Product Team (AWA IPT) would review the results of the T&I team and then recommend approval to add the widget to the PEO C4I Storefront for distribution to the afloat users. Despite being fielded earlier, the widgets would still be part of the larger, Operational Test Report as well. This process allows for a needed capability to be agilely created and deployed in a time sensitive manner.

Challenges

While the widget governance process discussed is technical feasible, and superior to the current acquisition system in both speed to the Fleet and cost, , significant challenges remain to the implementation of the widgets governance framework. There are a number of different individuals and offices in the DoD that must be “brought on board” for this process to work.

The first crucial step is for the DoD as a whole to understand the importance of acquisition reform, in particular, acquisition reform that is designed to facilitate the rapid acquisition of software applications and widgets. Fortunately, progress is being made at the OSD level. The Undersecretary of Defense for Acquisition, Technology, and Logistics (AT&L), Mr. Frank Kendall, has been working on a series of Better Buying Power initiatives designed to reform the acquisition process and change the culture of the acquisition community within DoD. Most recently, his Better Buying Power 2.0 strategy, released in November 2013, focuses on continuing to increase performance while implementing new initiatives. As Mr. Kendall states in his memo “this represents a management philosophy of continuous improvement in our acquisition practices.”¹⁹ The strategy is divided into seven focus areas, in each of these areas there are several new initiatives. The following initiatives are particularly important for increasing the acceptance and the future implementation of the agile acquisition process need for the DoD application stores.

In the focus area, “Control Costs Throughout the Product Lifecycle” the initiative regarding the cost performance of programs and institutions is particularly applicable to the use of C2 widgets and apps. The initiative states:

Institute a system to measure the cost performance of programs and institutions and to assess the effectiveness of acquisition policies: The Department will become more data driven in assessing its own and industry’s performance at

¹⁹ Frank Kendall, Undersecretary of Defense for Acquisition, Technology, and Logistics, *Global Trends 2030: Alternative Worlds* (Washington D.C.: Department of Defense, November 13, 2012), 1.

achieving improved productivity. The Department will develop metrics for the programs and institutions (government and nongovernment) within the acquisition system and assess performance to better understand best practices in industry and government.²⁰

The process of developing a new widget and sending it through the governance process described in Figure 4 takes measurably less time and manpower than the current system of deploying new capabilities into the systems manually. Thus, if widgets and the applications stores are examined with the metrics to be developed by this initiative, they will be more cost-effective. Additionally, widgets enable an existing program of record to be updated without large costs, thereby reducing the total lifecycle cost of any C2 program of record.

In the focus area “Eliminate Unproductive Processes and Bureaucracy” the initiative focusing on reducing cycle time while ensuring sound investment decisions speaks directly to the problem that the widget governance system can solve. The initiative states:

Reduce cycle times while ensuring sound investment decisions: This initiative will assess the root causes for long product cycle times, particularly long development cycles, with the goal of significantly reducing the amount of time, and therefore cost, it takes to bring a product from concept to fielding.²¹

The widget governance process will achieve the stated “goal of significantly reducing the amount of time, and therefore cost” while deploying C2 widgets that the end user has had significant input into. This will create a better product, while reducing time and cost.

Finally, in the focus area “Promote Effective Competition” the initiative focusing on open system architectures will encourage the creation of many different widgets, as the underlying system (in this case OWF) has an open architecture. The initiative states:

Enforce open system architectures and effectively manage technical data rights: This item is continued from BBP 1.0 and will focus on improving the Department’s early planning for open architectures and the successful execution of the plan to provide for open architectures and modular systems.²²

²⁰ Frank Kendall, Undersecretary of Defense for Acquisition, Technology, and Logistics, *Global Trends 2030: Alternative Worlds* (Washington D.C.: Department of Defense, November 13, 2012), 2.

²¹ Frank Kendall, Undersecretary of Defense for Acquisition, Technology, and Logistics, *Global Trends 2030: Alternative Worlds* (Washington D.C.: Department of Defense, November 13, 2012), 4-5.

²² Frank Kendall, Undersecretary of Defense for Acquisition, Technology, and Logistics, *Global Trends 2030: Alternative Worlds* (Washington D.C.: Department of Defense, November 13, 2012), 5.

The expansion of the use of open architectures and modular systems in software design will encourage many different widget developers, across the Services, to create, test and validate widgets that can be used across different platforms. As the number of widgets created and used increases, the ability of the end user to create truly composable C2 increases as well.

As the focus areas and initiatives in the DoD's Better Buying Power 2.0 show, there is a lot of room for growth in the acquisitions system, however some progress is being made. Unfortunately, the fact that many of the initiatives in Better Buying Power 2.0, released in 2013, are identical to those from Better Buying Power 1.0, released in 2010, highlights the difficulty in changing the culture in the DoD.

Acquisition Culture Change

Despite the many hurdles that the rapid IT process, widget governance process and the OMP still have to face, it has become clear that the DoD can no longer continue down its current acquisition path of providing yesterday's solutions to meet today's immediate needs. With the growing demand from the warfighter for rapidly deployed and composable C2 solution tools, the acquisition culture is benefiting from increasing incentives to adopt new processes like the OWF framework, the DoD Application Store, and the Rapid IT governance process. This demand coming from the "bottom up" is being met by changes coming from the "top down." Like the warfighter on the ship, the policymakers in the Pentagon are eager for substantial change to the IT acquisition system. The commitment from the DoD to create and implement the Better Buying Power 2.0 directive bodes well for the continued adoption of the OWF framework, the DoD Application Store, and the Rapid IT governance process. As Programs of Record continue to use light-weight web applications and widgets, and have them accredited and fielded quickly, the processes which are in their infancy today will develop into standards.

Conclusion

The current DoD method of providing an "exquisite" product after a lengthy development cycle is one geared towards procuring platforms and hardware. This acquisition cycle must change to enable the DoD to follow the trend in the commercial world where they deliver small, lightweight mobile applications to an application store thereby providing a consistent stream of new capabilities to its customers. Lightweight web applications can supply the warfighter with valuable information and can be developed in a short period time since they are comprised of a generally small amount of code. New widget technologies and smaller testing efforts that make new capabilities available within an application store will introduce a paradigm shift in the development and delivery of capabilities to the warfighter. With shortened development times,

immediate user needs can be addressed and satisfied more quickly. This will increase the ability of the warfighter to utilize agile C2 to address rapidly changing scenarios in the field.



“DoD Application Store: Enabling C2 Agility?”

**19th International Command and Control Research Symposium
“C2 Agility: Lessons Learned from Research and Operations”
Track: 3**

**Presenters: Mr. Michael Morris and Captain (Ret.) George Galdorisi
Co-Authors: Ms. Amanda George and Mr. Mathew O’Neil**

SPAWAR Systems Center Pacific

Outline

- ▼ Information: Key Warfighting Domain
- ▼ Defense Acquisition System Challenges
- ▼ Overview of Recommended Solution
- ▼ Conclusion

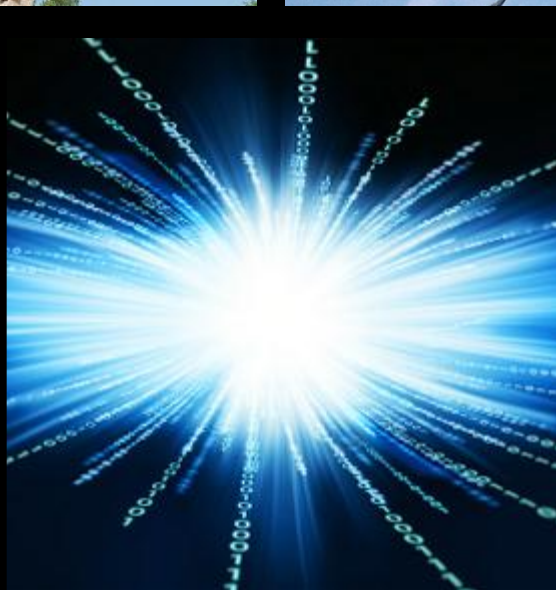
Information: A Key Warfighting Domain

“[T]he Navy will create a fully integrated C2, information, intelligence, cyberspace, environmental awareness, and networks operations capability and wield it as a weapon and instrument of influence.”

U.S. Navy Information Dominance Vision
United States Navy, Information Dominance Corps
May 2010

Warfare Domains

L
a
n
d



Information

S
e
a



A
i
r



S
p
a
c
e



“The Navy is pursuing improved information-based capabilities that will enable it to prevail in the higher-threat, information-intensive combat environments of the 21st Century.”

U.S. Navy Information Dominance Roadmap
United States Navy, Information Dominance Corps
March 2013

Two Challenges



In a world of information overload, how do we ensure we get the right information to right warfighter at the right time?



In a world of budget constraints, how can we agilely shift our mission, and the C2 capabilities needed, to respond to a new demand?



Defense Acquisition Challenges

Challenge

- ▼ Industry has already fine-tuned its use of widgets and mobile applications
 - Rapidly evolving software development paradigm
 - A driving force in delivery of web-based dynamic content
- ▼ Using standard acquisition processes in DOD, by the time new solutions are deployed to the warfighter, the technology is obsolete
- ▼ Several programs within the DOD have started similar initiatives that hold the promise of reducing the “heavy lifting” required as part of the current acquisition process

Defense Acquisition System Challenges

- ▼ Defense Acquisition System was designed to purchase “big ticket” items like aircraft carriers and fighter planes
- ▼ Excessive development and update cycles
 - Private sector cycles are 12 -18 months
 - Defense IT systems routinely require 48 - 60 months



Average Build Time: 7+ years

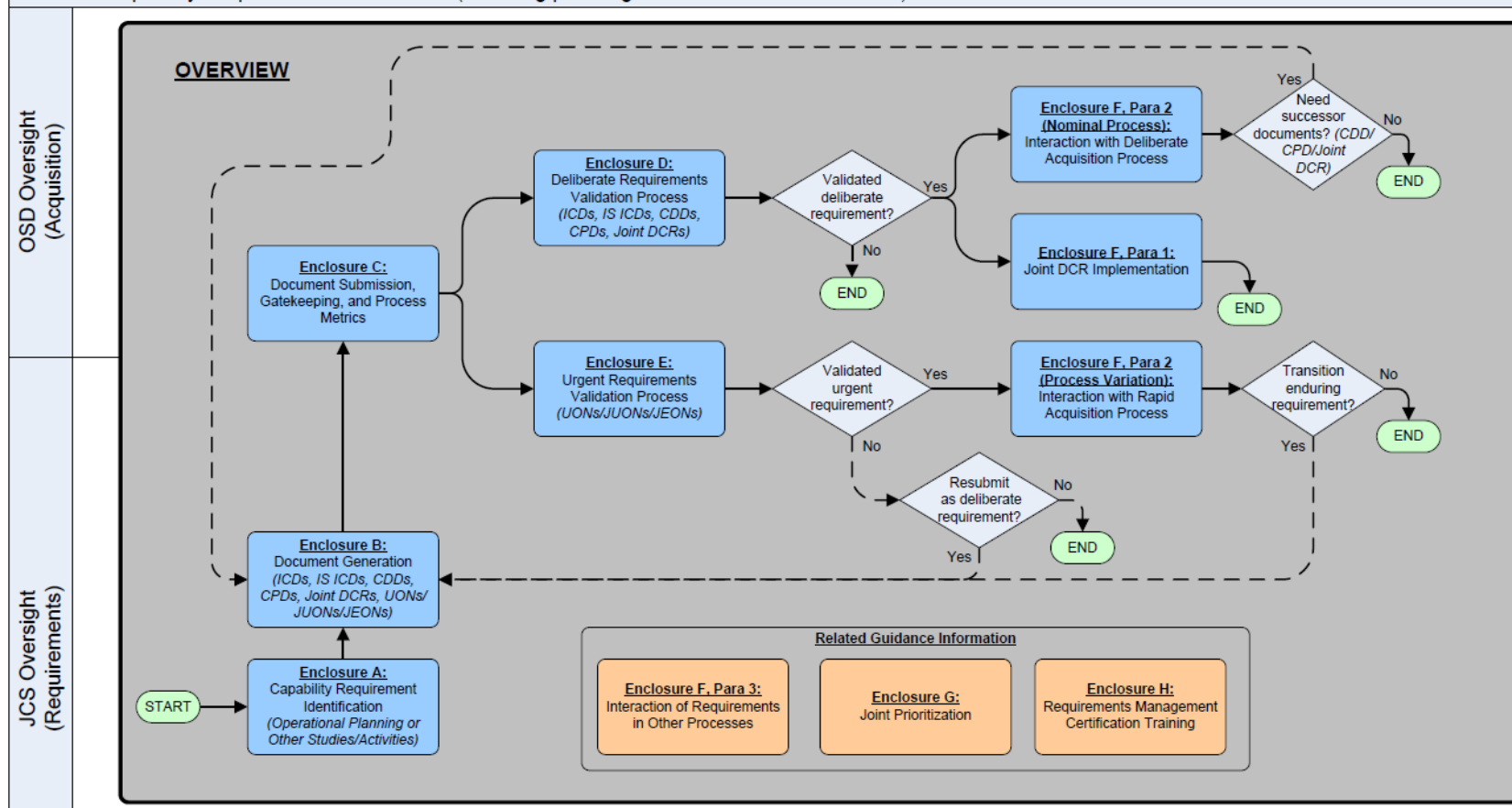


Average Build Time: 18 mos.

The Current Process

Joint Capabilities Integration and Development System (JCIDS) Process Flow Chart

Capability Requirement Identification (including planning, studies, and other activities)



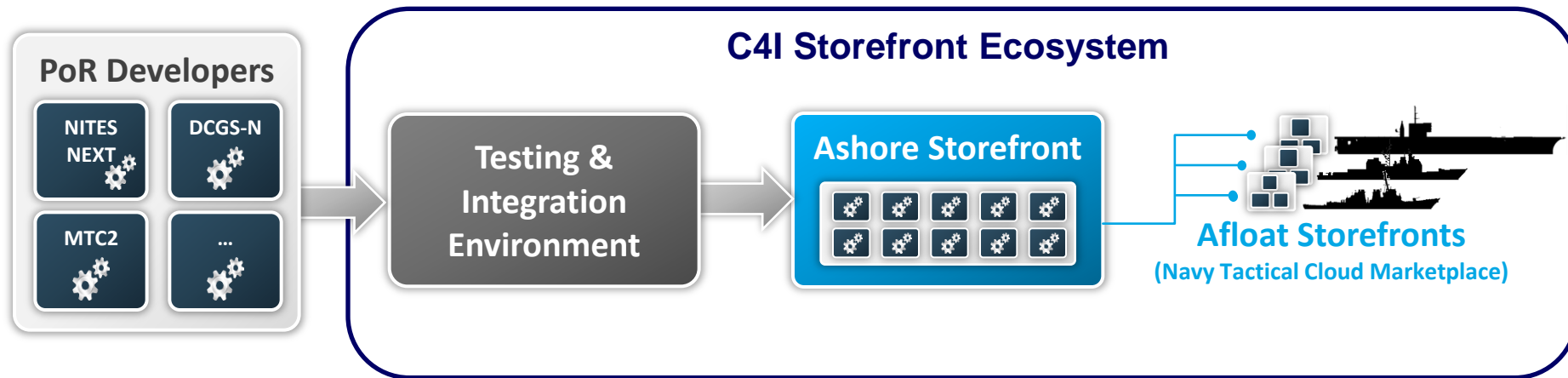
Overview of Recommended Solution

Overview of Recommended Solution

- ▼ A lightweight web application test and integration (T&I) environment
 - Needed to model, test, exercise, and perform certification and accreditation of widget capabilities
- ▼ A Widget T&I environment is required for widget technology development throughout the DOD
- ▼ A widget T&I environment is needed that incorporates the unique and common aspects of Navy widget environments



PEO C4I Storefront *Overview and Benefits*



Increased Speed to Capability

CAPABILITY DEVELOPMENT

Current (12 – 18 Months)

Proposed (6 Months)



TESTING (OT & IA)

Current (6 – 8 Months)

Proposed (2 – 3 Weeks)



FIELDING

Current (2 Weeks)

Proposed (Days)



Reduced Total Ownership Costs

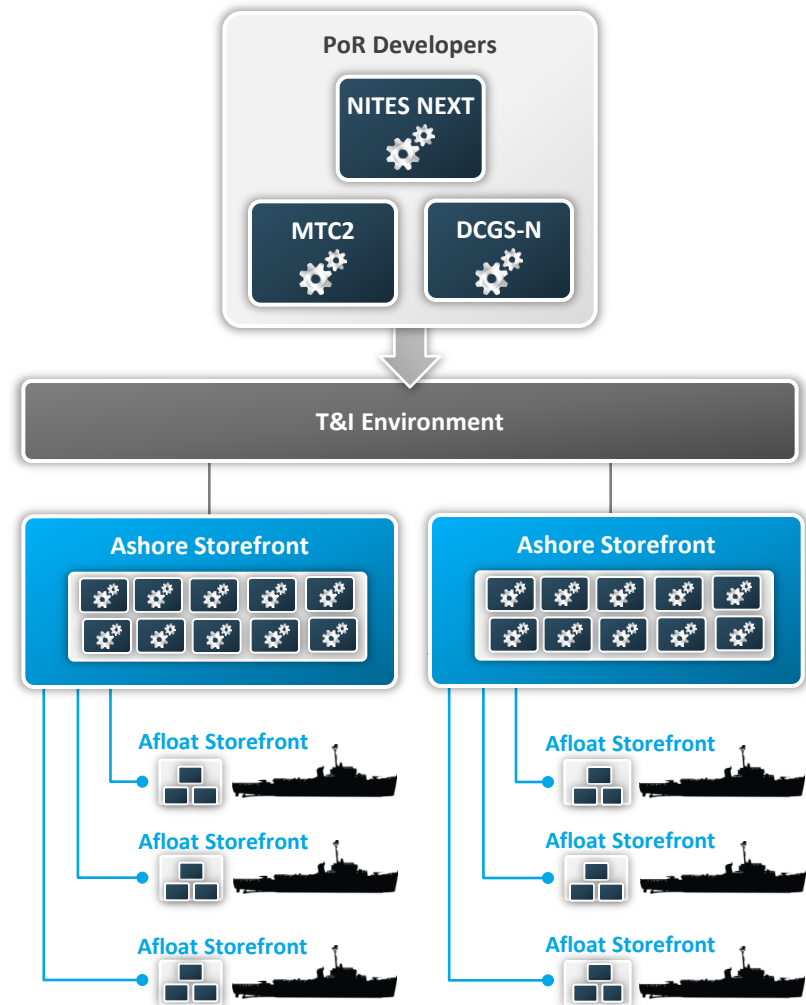
- Cost per app rather than per platform
- Fielding cost down
 - Upload once; available for all approved platforms
 - Automate delivery of widgets, applications, and services
 - No tech visit necessary for installation
- Sustainment cost down
 - Automate distribution of updates / patches



New OV-1

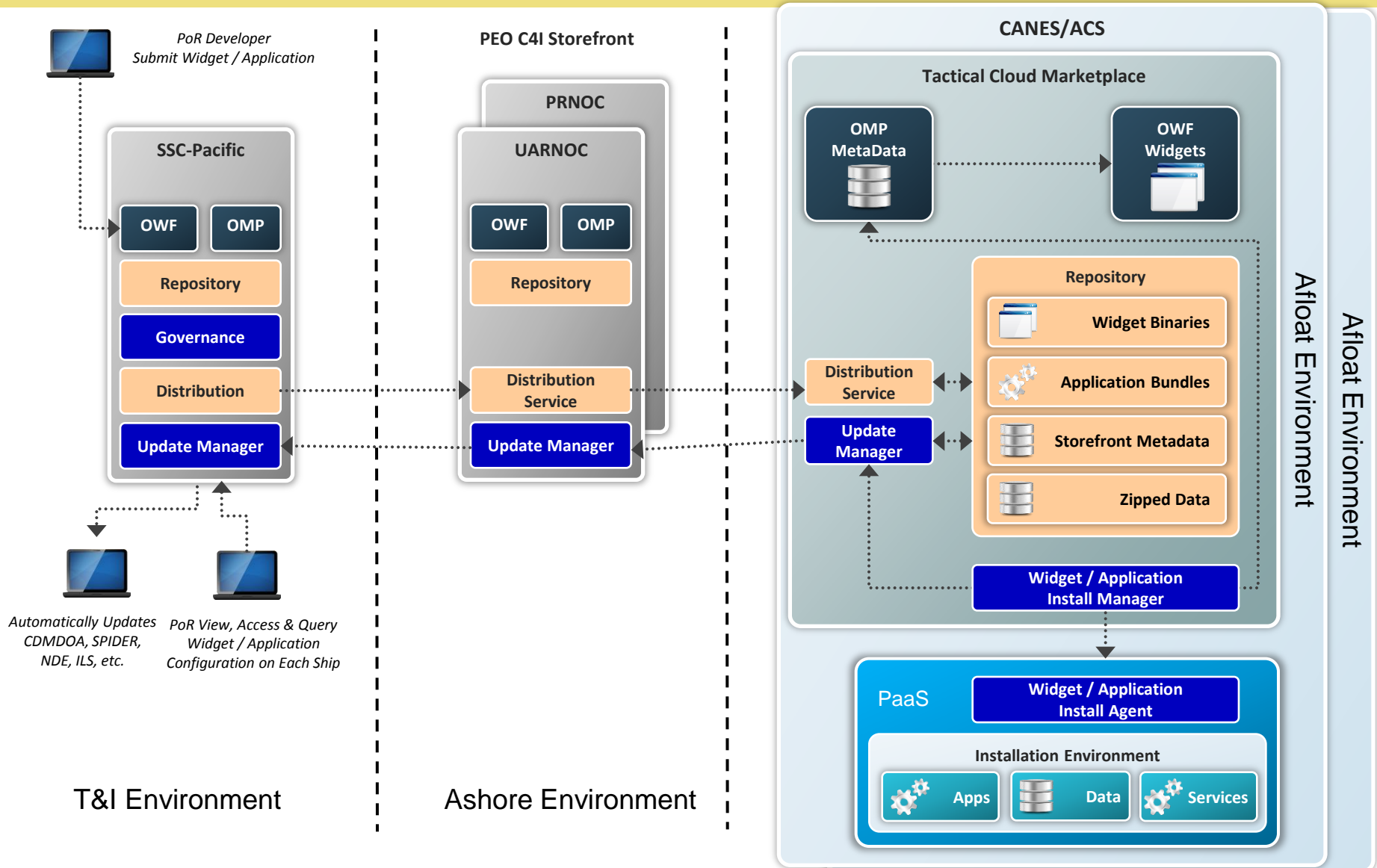


- The Storefront T&I environment provides:
 - Automated submission of new warfighter capabilities
 - Manual and automated integration, functional, and IA testing of widgets and applications
 - Rapid approval process to push new warfighter capabilities to the operational environment
- The PEO C4I Storefront provides:
 - PEO C4I capabilities to ashore users
 - Distribution of PEO C4I capabilities from ashore to the tactical environment
- The Navy Tactical Cloud Marketplace provides:
 - Afloat users the ability to discover, access, and use PEO C4I capabilities
 - Provides feedback on capabilities received, updated, and installed back to the PEO



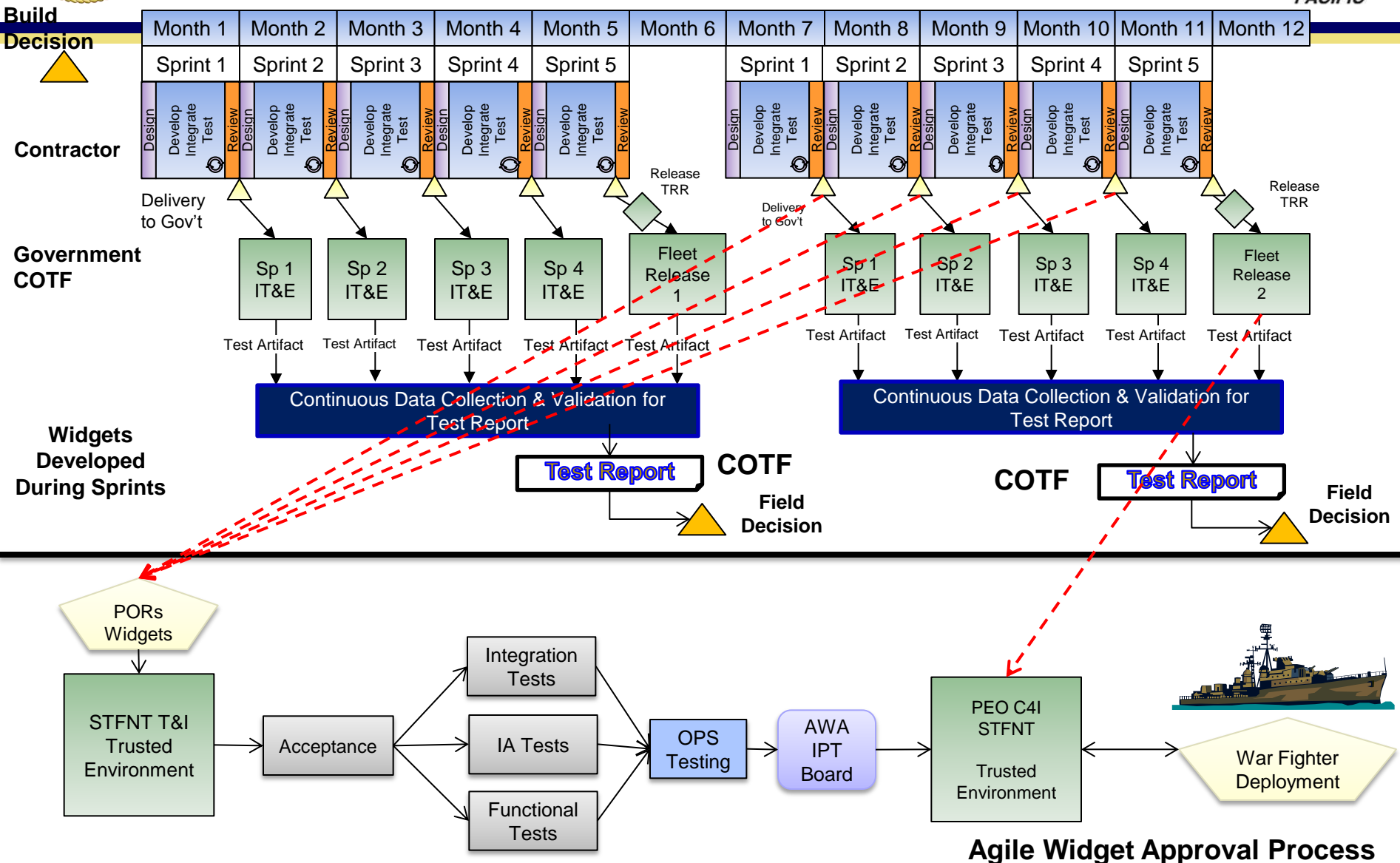


Navy App Store Enterprise

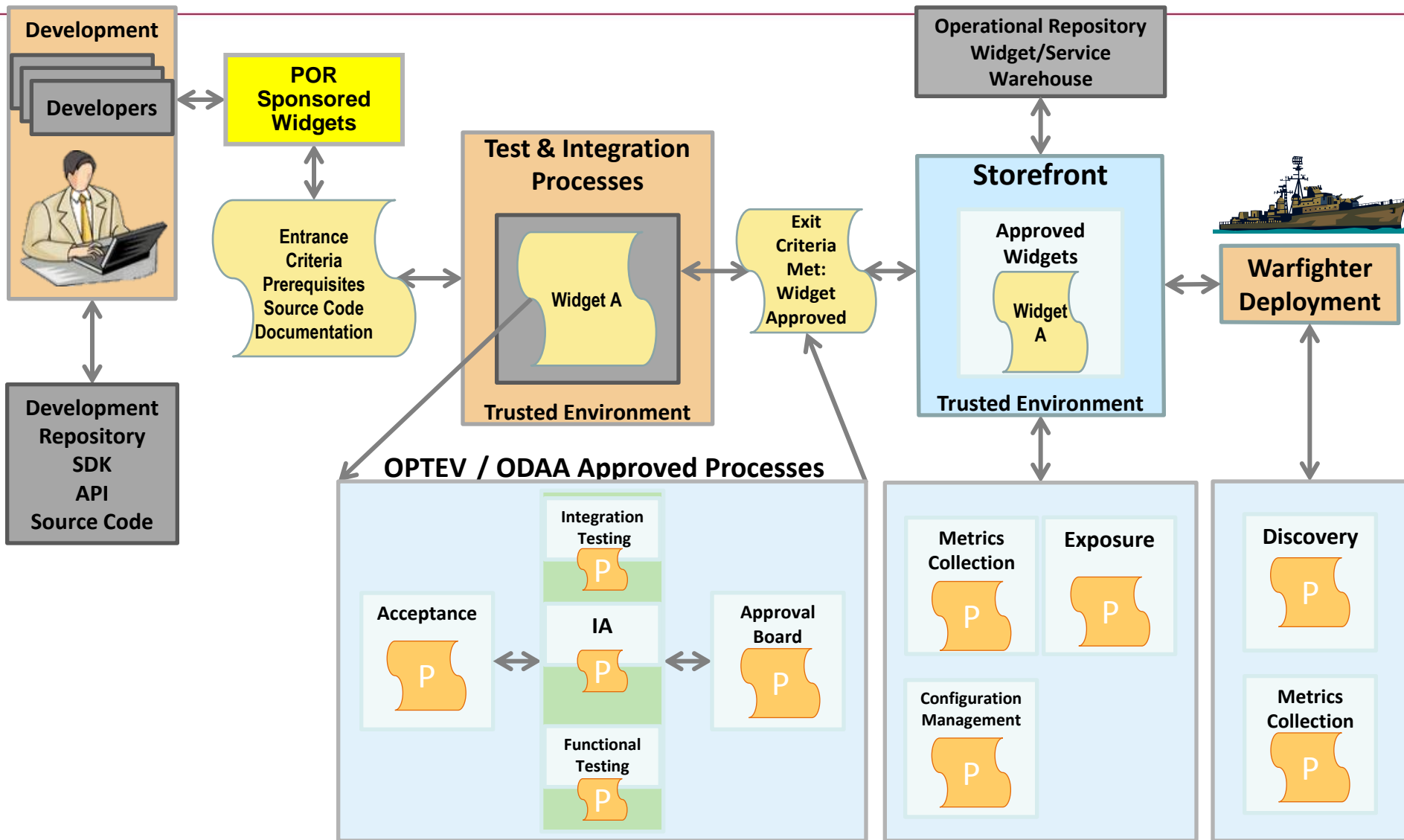




Rapid IT Process & Agile Widget Process



Proposed Widget Governance Process



Conclusion

Conclusion

- ▼ **Rapid IT acquisition is a way to provide the warfighter with composeable C2**
- ▼ **Composeable C2 capabilities enable our warfighters to innovate in theater to provide the right information, to the right people, at the right time**

**“The only response to change is innovation.”
— John Kao**

Presenter Contact Information

Mr. Michael Morris

michael.a.morris4@navy.mil

619-553-1260

Captain (Ret.) George Galdorisi

George.galdorisi@navy.mil

619-553-2104

BACKUPS

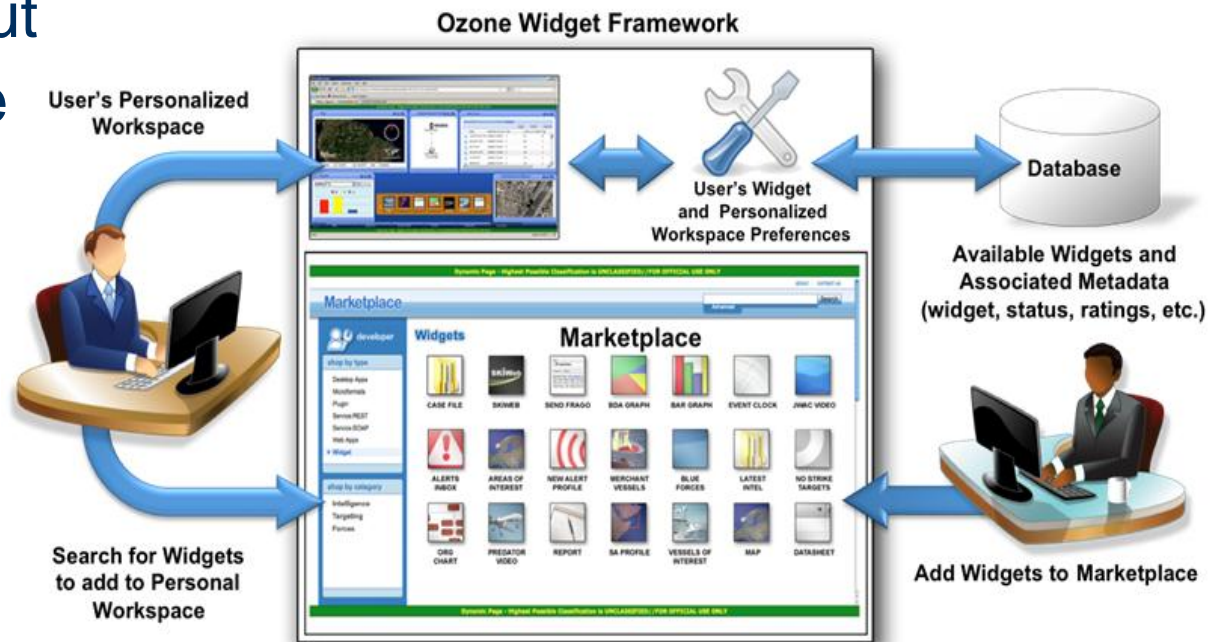
Industry Approach

- ▼ Current acquisition rules required for POR systems have caused a major gap between the technology available to the warfighter and that which is available commercially
 - Exacerbated by capabilities of smartphones and tablet computers
 - Greater gap for younger service members raised on commercial technologies and then forced to use outdated systems

- ▼ Apple and Google are both known for their mobile operating systems and the applications (or “apps”) that run on them
 - Both companies have “app” stores that allow developers to rapidly deploy applications, but they do so in very different ways

Ozone Widget Framework

- ▼ A platform that offers infrastructure services to simplify the development of workflows and presentation-tier application integration
- ▼ It is also a layout manager for the operation of widgets on a single web page

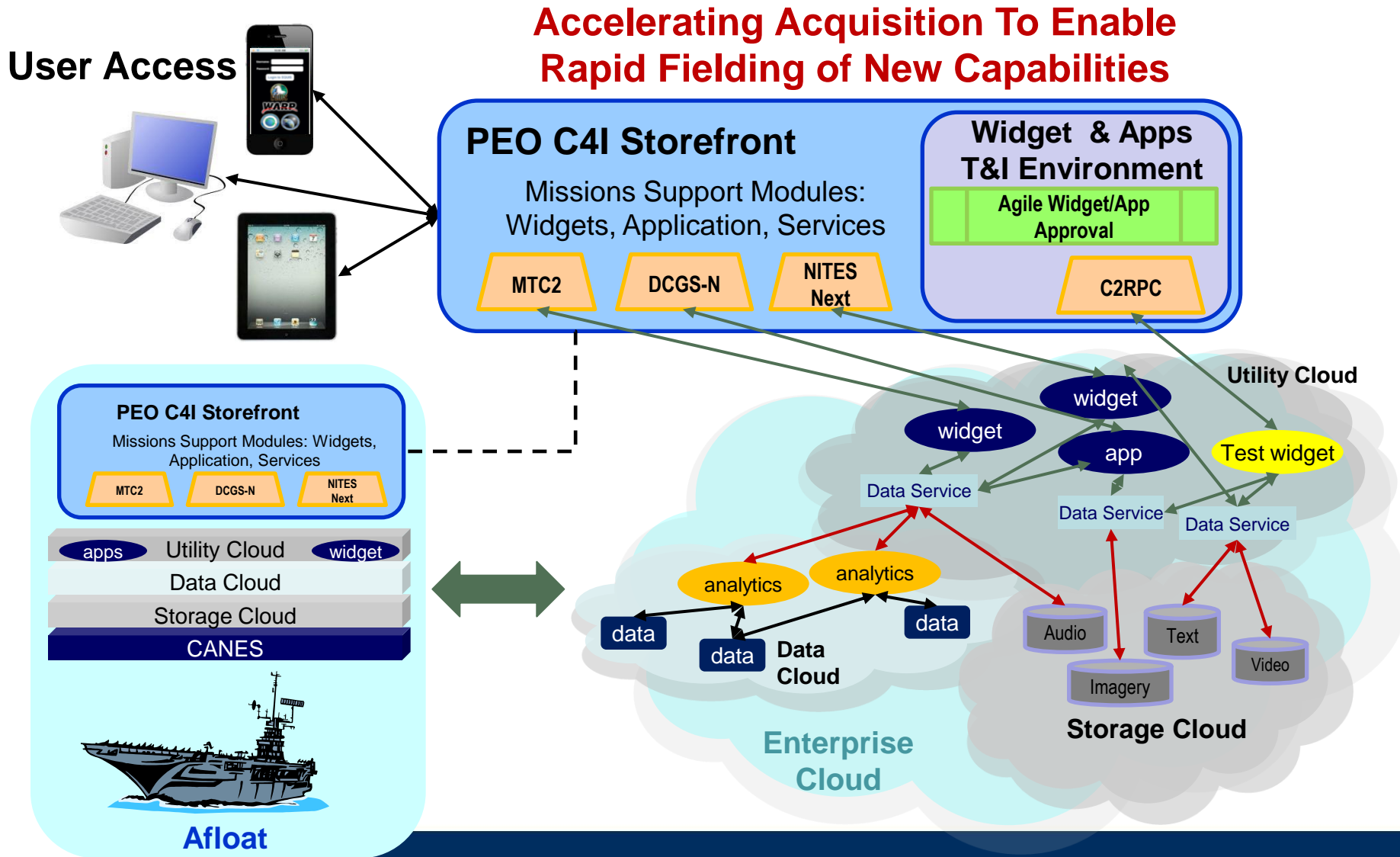


PEO C4I Storefront Vision

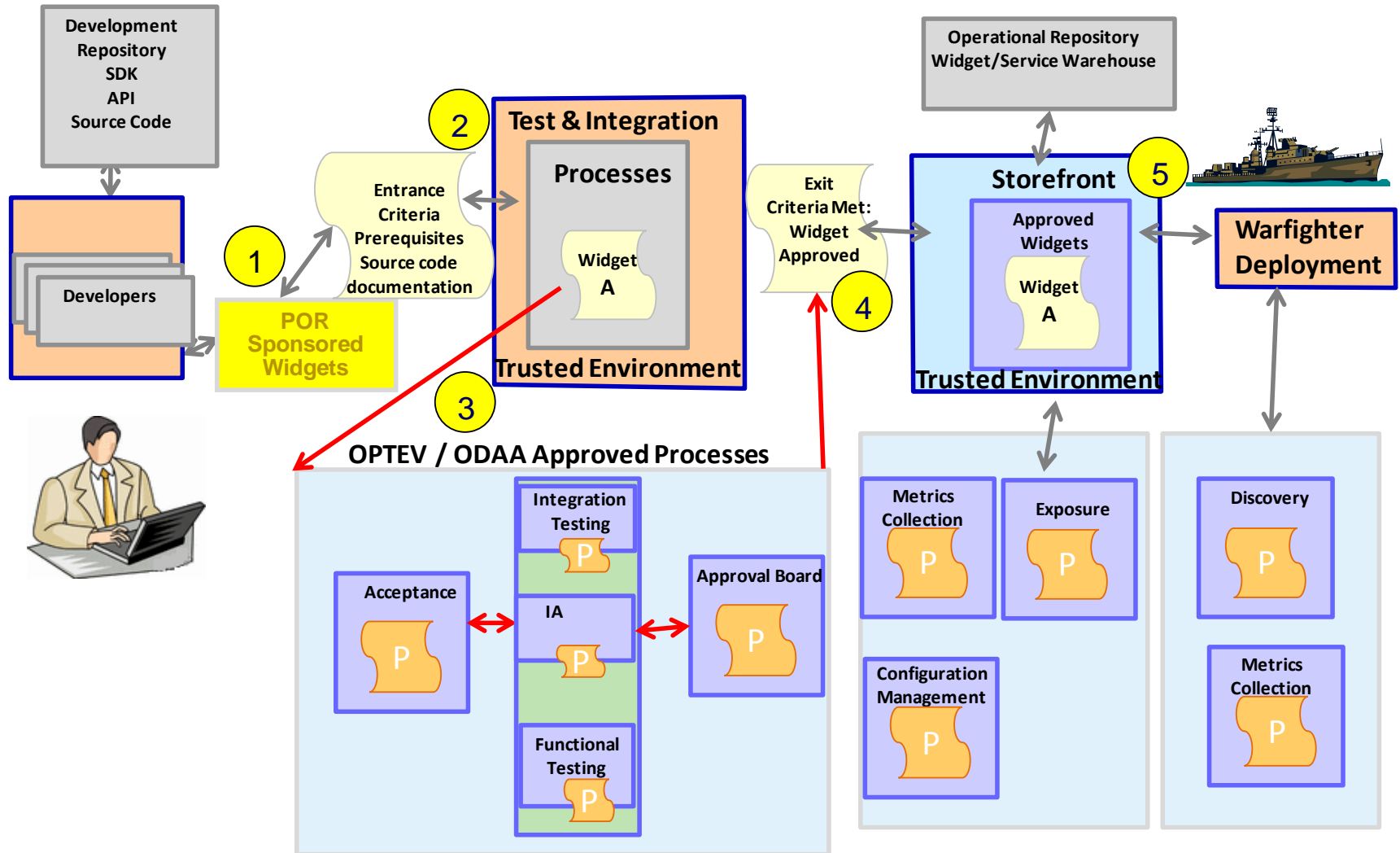


- ▼ Warfighters access *all* C4I capabilities via a *single*, browser-based C4I Storefront
 - Widgets
 - Applications
 - Updates / Patches
- ▼ Common PoR processes and a standard mechanism for deployment
- ▼ Positive control and visibility into the C4I systems and version available on the network

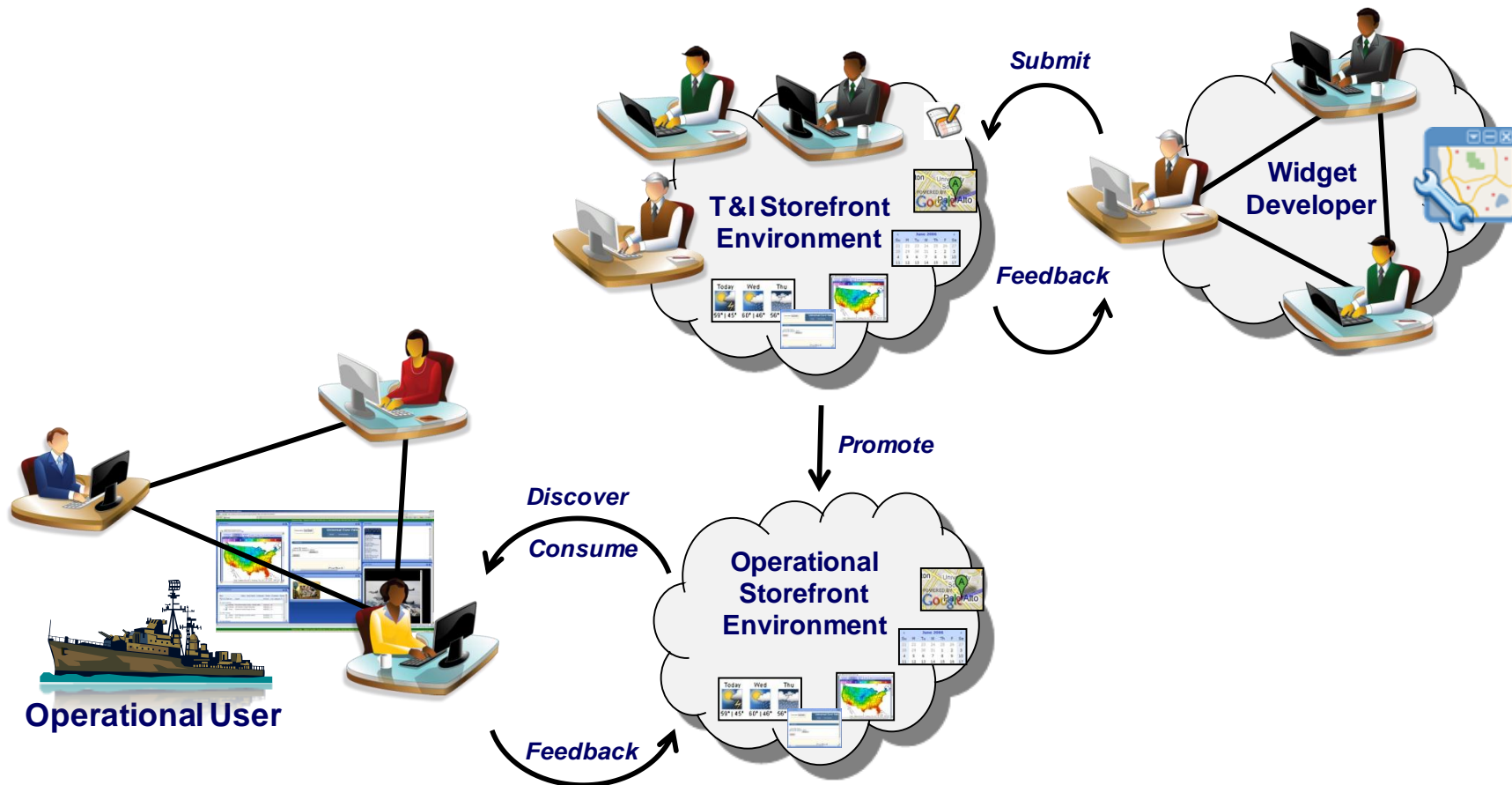
PEO C4I Storefront & Navy Cloud



Widget Governance Process Overview



Storefront Operational Concept



What is a Widget?

- ▼ Lightweight
- ▼ Single-purpose
- ▼ User configured
- ▼ Web-enabled application
- ▼ Provides summary information or a limited view into a larger application
- ▼ Also used alongside related widgets to provide an integrated view

Better Buying Power and Culture Change

▼ Better Buying Power 2.0

- Control Costs Throughout the Product Lifecycle
 - Supports the rapid IT widget governance process
- Eliminate Unproductive Processes and Bureaucracy
 - Supports the widget governance process with increased user input
- Promote Effective Competition
 - Encourages the creation of more widgets